

**Antibiotic Prescriptions Associated with Outpatient Visits for Acute, Nonbacterial
Respiratory Tract Infections among Adult Medicaid Recipients in North Carolina**

**A Report to the Division of Medical Assistance
by
Medical Review of North Carolina, Inc (MRNC)**

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Abstract

Background. North Carolina and the Southeastern United States have among the highest antimicrobial resistance rates for common respiratory tract pathogens in the nation. The excessive use of antibiotics for common outpatient infections is a major contributing factor in the emergence of antibiotic resistant bacteria.

Objective. To estimate the prevalence of oral antibiotic treatment for acute, nonbacterial respiratory tract infections among adult Medicaid recipients in North Carolina, and to describe a pilot project aimed at reducing the prevalence of oral antibiotic treatment among this population.

Methods. Using administrative claims data, we identified 24,137 Medicaid recipients, aged 18 to 64 years, who made at least one outpatient physician visit for acute nasopharyngitis (*ICD-9, 460.x*), acute pharyngitis (*462.x*), acute upper respiratory infection (*465.9*), acute bronchitis (*466.0*), or influenza (*487.1*) between October 1, 2000 and March 29, 2001. We excluded adults with chronic bronchitis (*ICD-9, 491.x*), emphysema (*492.x*), asthma (*493.x*), or chronic obstructive pulmonary disease (*496.x*). Pharmacy claims data were used to identify oral antibiotic treatment occurring within 5 days of the outpatient visit.

Results. Overall, 63% ($n=15,189$) of Medicaid recipients who made at least one outpatient visit during the observation period for one of the study conditions filled a prescription for an oral antibiotic within 5 days. Factors associated with receiving an antibiotic were older age (test of trend, $p<0.01$), male gender (64% vs. female, 63%, $p=0.04$), white race/ethnicity (64% vs. non-white, 62%, $p=0.01$), rural county of residence (64% vs. urban, 61%, $p<0.01$), and residence in the Eastern region of the state (65% vs. Western region, 59%, $p<0.01$). These associations, with the exception of racial/ethnic differences, remained after multivariable adjustment and were independent of the number of outpatient visits made. Compared with the other principal study

diagnoses, patients with acute bronchitis (44% of all outpatient visits) were 2.88 (95% CI=2.72, 3.05) times more likely to receive oral antibiotic treatment after multivariate adjustment.

Summary. The prevalence of oral antibiotic treatment among adult beneficiaries diagnosed with nonspecific upper respiratory infections, colds, pharyngitis, bronchitis, and influenza is greater than desirable levels and varies across patient demographics and geographic areas. Interventions to reduce antibiotic prescribing are needed to reduce the progression of antimicrobial resistance and to lower healthcare costs.

Introduction

Antimicrobial resistance among common bacterial pathogens is increasing at an alarming rate, both in hospitals and in the community. *S. pneumoniae*, or the pneumococcus, is the leading cause of community-acquired pneumonia, bacterial sinusitis, meningitis and otitis media in the United States (1). Through 1980, virtually 100 percent of pneumococci in the United States were fully susceptible to penicillin. During the five year period from 1994–1995 to 1999–2000, penicillin susceptibility decreased from 76 percent to 66 percent and erythromycin susceptibility decreased from 90 percent to 74 percent (2).

The Southeastern United States has demonstrated the lowest susceptibility of all regions of the nation. The overall proportion of penicillin non-susceptible pneumococci within a seven region, population-based, active surveillance program across the United States in 1997 was 25 percent (3). Non-susceptibility ranged from a low of 15 percent in Maryland to a high of 38 percent in Tennessee. In another pneumococcal resistance tracking program from 2000–2001, full penicillin resistance was found in 9.7 percent of isolates from the northwest, 13.1 percent from the northeast, and 22.2 percent from the southeast (4). Similarly, azithromycin resistance was found in 24.0 percent of isolates from the northwest, 20.1 percent from the northeast, and 32 percent from the southeast. Among pneumococci tested at North Carolina hospitals during 2000, 32 percent were fully resistant to penicillin and 39 percent were resistant to erythromycin. Pneumococci resistant to erythromycin are also resistant to azithromycin and clarithromycin (5).

The excessive use of antibiotics in the outpatient setting has contributed to the increase in antimicrobial resistance (6–9). Infectious diseases account for approximately 19 percent of visits to physicians, or on average 129 million visits per year nationally (10). Projections from a study of the National Ambulatory Medical Care Survey estimate 76 million primary care office visits

for acute respiratory tract infections resulting in 41 million prescriptions in a one year period (11). In 1992, 21 percent of all antibiotic prescriptions among adults resulted from office visits for colds, upper respiratory tract infections, and bronchitis (12). Antibiotics were prescribed for 51 percent of patients diagnosed with colds, 52 percent with upper respiratory tract infections, and 66 percent with bronchitis after exclusion of patients with underlying lung disease (12).

The progression of antimicrobial resistance can be reversed. In Finland, nationwide reductions in the use of macrolides resulted in a significant decline in the frequency of erythromycin resistance among Group A streptococci (13). Kristinsson reported an aggressive campaign in Iceland that resulted in a decline of pneumococcal penicillin resistance from 20 percent in 1993 to 16.9 percent in 1994 (14).

The American College of Physicians-American Society for Internal Medicine, American Academy of Family Physicians, Infectious Diseases Society of America and Centers for Disease Control and Prevention have endorsed a campaign to promote appropriate antibiotic use for the treatment of acute respiratory tract infections in adults, and Clinical Practice Guidelines providing evidence-based recommendations have been published (15). These provide practical strategies for limiting antibiotic use to the patients who are most likely to benefit, and do not apply to immuno-compromised individuals or those with significant cardiac or pulmonary disease.

This analysis describes the prevalence of oral antibiotic treatment for acute, nonbacterial respiratory tract infections among adult Medicaid recipients in North Carolina by recipient characteristics. In addition, we describe a pilot project that has been initiated to reduce antimicrobial use for common upper respiratory tract infections in this population.

Methods

Data and Study Population

The study population of interest was all adult North Carolina Medicaid recipients. The study sample included Medicaid recipients aged 18 to 64 years as of January 1, 2001 who participated in the following systems of care within the North Carolina Medicaid program: fee-for-service, Carolina ACCESS, ACCESS II & III, and Healthcare Connection. Briefly, Carolina ACCESS is a program designed to provide more efficient and effective healthcare delivery to Medicaid recipients by linking each eligible recipient with a primary care provider (16). The ACCESS II & III program further builds on the Carolina ACCESS program by working with local providers and networks to better manage the Medicaid population with processes that impact both the quality and cost of healthcare (16). Healthcare Connection operates in Mecklenburg County, NC and requires enrollment in a health maintenance organization.

We obtained Medicaid outpatient and pharmacy claims data from the North Carolina Division of Medical Assistance, the state program that oversees North Carolina's Medicaid program. Outpatient claims data were obtained for the period April 1, 2000 through March 31, 2001, and pharmacy claims data were obtained for a similar period. Using *Current Procedural Terminology (CPT)* and *International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM)* codes, we identified visits to physicians' offices (*CPT codes 99201–99205, 99211–99215, 99241–99245*) and emergency departments (ED) (*99281–99285*) for which the principal diagnosis was acute nasopharyngitis (*ICD-9, 460.x*), acute pharyngitis (*462.x*), acute upper respiratory infection (*465.9*), acute bronchitis (*466.0*), or influenza (*487.1*). Outpatient visits were further restricted to those where the physician was located in North Carolina and where the physician-designated specialty was family practice, general practice, or

internal medicine (for office or ED visits) or full-time ED physician or multi-specialty (for ED visits).

The analysis is focused on outpatient visits that occurred between October 1, 2000 and March 29, 2001. This six-month time period accounted for 67 percent ($n=37,851$) of the 56,333 outpatient visit claims by adults for the study diagnoses that took place during the one-year period April 1, 2000 through March 29, 2001. We excluded persons who were not aged 18 to 64 years ($n=188$) as of January 1, 2001 as well as those with chronic conditions for which oral antibiotic treatment might be appropriate therapy. Chronic conditions were identified by examining outpatient claims data 90 days prior to the index (i.e., first) visit for each recipient and were defined by two or more office visit claims at least six days apart for which the principal diagnosis on each claim was chronic bronchitis (*ICD-9, 491.x*), emphysema (*492.x*), asthma (*493.x*), or chronic obstructive pulmonary disease (*496.x*). A total of 647 Medicaid recipients were excluded due to the presence of a chronic condition, leaving a total of 30,961 outpatient claims for 24,137 Medicaid recipients available for analysis (Figure 1).

Antibiotics were identified by one of the authors (M.K.) using the *Physician's Desk Reference* and the *National Drug Code Directory*. For each of the antibiotics listed in Appendix B, National Drug Code numbers were obtained from the Multum Lexicon™ database (Multum Information Services, Inc., Denver, CO, 2001) and used to identify oral antibiotic prescriptions in the Medicaid pharmacy claims database. We retained medications where the associated route of administration was oral. Using the dates of service from the outpatient and pharmacy claims, we calculated the number of days between each outpatient visit claim and each prescription claim to determine whether a prescription was made within five days of the outpatient visit. We repeated analyses using three-, seven-, and ten-day periods.

Analysis

The primary outcome of interest was the prevalence of oral antibiotic treatment received within five days of a outpatient physician visit for one of the acute, nonbacterial respiratory tract infections listed above among persons making at least one outpatient visit. Persons with more than one outpatient visit followed by oral antibiotic treatment within five days are counted only once in the numerator of the prevalence calculation.

The prevalence of oral antibiotic treatment is described by Medicaid recipient characteristics including age, gender, race/ethnicity, and residence area (urban vs. rural; regional). The Medicaid data maintains six racial/ethnic categories (White, Black, Hispanic, Asian/Pacific Islander, American Indian/Alaska Native, and Other). Due to small numbers, we collapsed the six categories into White, Black, and Other. Urban areas are defined as counties that include a standard metropolitan statistical area as defined by the U.S. Bureau of the Census in 1990 with a population density greater than 190 residents per square mile, and rural areas are defined as those with fewer than 190 residents per square mile. Urban counties are highlighted in Appendix A. We also present region-specific prevalence of antibiotic treatment for the nine regions that comprise the North Carolina Area Health Education Centers (AHEC) Program. The aim of the North Carolina AHEC Program, in part, is to enhance the quality of care and improve the health outcomes of the State's residents, particularly in underserved communities and populations. The individual counties used to define the North Carolina AHEC regions are listed in Appendix A. The Medicaid recipient's county of residence is the basis for these assignments.

All statistical analyses were performed using SAS v8.2 statistical software (SAS Institute, Inc., Cary, NC). Statistical comparisons of categorical variables across groups were performed

using Pearson's chi-square statistic. Prevalence estimates adjusted for the number of outpatient visits were obtained using direct standardization and the outpatient visit distribution of the total sample as the standard. Logistic regression was used to obtain prevalence odds ratios. Multivariable adjusted models controlled for age, gender, race/ethnicity, and rural/urban residence area unless noted otherwise. Model parameter estimates were computed by maximum likelihood techniques and 95 percent confidence intervals (95% CIs) were based on the standard error of the model coefficients.

Results

Population Description

A total of 24,137 adult North Carolina Medicaid recipients made 30,961 outpatient visits for acute, nonbacterial respiratory tract infections between October 1, 2000 and March 29, 2001. Nearly 25 percent of visits were to the emergency department ($n=7478$), and 55 percent of outpatient visits were seen by a general practice or family practice physician ($n=16,943$). More than 50 percent of the Medicaid recipients were less than 40 years of age, more than 75 percent were women, and 44 percent were non-white. Thirty-one percent of persons resided in an urban area. (N.B.—During State Fiscal Year 2000, a total of 1,221,266 persons were eligible for Medicaid in North Carolina (16). Forty-one percent, or 500,434 persons, resided in an urban area while 59 percent resided in a rural area.) The proportion of Medicaid recipients residing in each of the nine North Carolina AHEC regions was 10.4 percent ($n=2508$) in the Mountain region, 18.2 percent ($n=4402$) in the Northwest region, 11.5 percent ($n=2769$) in the Charlotte region, 9.9 percent ($n=2377$) in the Greensboro region, 14.2 percent ($n=3419$) in the Southern region, 9.0 percent ($n=2174$) in the Wake region, 4.5 percent ($n=1091$) in the Area L region, 5.8 percent ($n=1395$) in the Coastal region, and 16.6 percent ($n=4002$) in the Eastern region.

Among the Medicaid recipients making at least one physician outpatient visit for a acute, nonbacterial respiratory infection, the mean number of visits was slightly more than one (mean=1.3; standard deviation=0.7; range=1–9). Fifteen percent ($n=4979$) of recipients made more than one outpatient visit. A total of 6645 recipients made at least one visit to the emergency department for a acute, nonbacterial respiratory infection (range=0–7).

We categorized Medicaid recipients into one of three groups based on the number of physician outpatient visits during the 6-month period. Nearly 80 percent ($n=19,158$) of Medicaid

recipients made one visit, 15.3 percent ($n=3700$) of recipients made two visits, and 5.3 percent ($n=1279$) made three or more visits. As shown in Table 1, Medicaid recipients making more than one physician outpatient visit were older and more likely to be women, white, and reside in a rural area compared to those who made only one outpatient visit for a acute, nonbacterial respiratory tract infection.

Between October 1, 2000 and April 5, 2001, 258,693 prescriptions for the oral antibiotics listed in Appendix A were identified in the Medicaid pharmacy claims database. Of these, 43,709 (17 percent) oral antibiotic prescriptions were filled by recipients making at least one physician outpatient visit for acute, nonbacterial respiratory tract infection. Among the 19,699 (82 percent) Medicaid recipients who filled at least one oral antibiotic prescription, the median number of prescriptions filled was 2.0 (interquartile range=2.0). Approximately 35 percent ($n=8471$) of the Medicaid recipients filled one oral antibiotic prescription; 22 percent ($n=5258$) filled two prescriptions; 12 percent ($n=2823$) filled three; and 13 percent ($n=3147$) filled four or more oral antibiotic prescriptions. The most common medications prescribed were azithromycin and amoxicillin (Table 2).

Prevalence of Oral Antibiotic Treatment by Recipient Characteristics

Overall, 63 percent of Medicaid recipients who made at least one outpatient visit during the observation period for acute, nonbacterial respiratory tract infections were treated within five days with an oral antibiotic. The prevalence of oral antibiotic treatment differed significantly across outpatient visit groups and recipient characteristics (Table 3). The prevalence of treatment was 59 percent among recipients who made only one visit, 77 percent among those who made two outpatient visits, and 86 percent among those who made three or more outpatient visits

(Cochrane-Armitage test of trend, $p < 0.001$). Older Medicaid recipients were slightly more likely to be treated with an oral antibiotic compared to younger recipients ($p < 0.01$), as were men compared to women ($p = 0.03$), and rural residents compared to urban residents ($p < 0.01$). The prevalence of antibiotic treatment was slightly lower among Whites and Blacks compared to persons of Other racial/ethnic groups ($p < 0.01$). These associations, with the exception of race/ethnicity, remained after multivariable adjustment and were independent of the number of outpatient visits.

Acute bronchitis (*ICD-9-CM 466.0*) and acute upper respiratory tract infection (*ICD-9-CM 465.9*) were the most common of the study conditions, accounting for 44 percent ($n = 13,739$) and 32 percent ($n = 9,812$), respectively, of outpatient visits (Figure 2). The prevalence of oral antibiotic treatment varied substantially across study principal diagnoses (Table 4). Compared with the other principal study diagnoses, recipients whose principal diagnosis was acute nasopharyngitis were significantly less likely to receive oral antibiotic treatment ($OR = 0.44$; 95% $CI = 0.42, 0.47$) independent of age, race/ethnicity, gender, residence area, and number of outpatient visits. In contrast, Medicaid recipients whose principal diagnosis was acute bronchitis were 2.88 (95% $CI = 2.72, 3.05$) times more likely to receive an oral antibiotic compared to those with other principal study diagnoses after multivariable adjustment.

The prevalence of oral antibiotic treatment also varied significantly by geographic area. Independent of age, gender, race/ethnicity, and the number of outpatient visits, residents of rural areas were 1.13 times more likely to be treated with an oral antibiotic than their urban counterparts (95% $CI = 1.06, 1.19$). And, across North Carolina AHEC regions, the prevalence ranged from 55 percent in the Mountain region to 67 percent in the Southern Regional area (Figure 3).

Sensitivity

We assessed the sensitivity of our prevalence measure to the amount of time allowed between an outpatient visit claim and a pharmacy claim. When the time frame was reduced from five days to three days, a total of 14,871, or 62 percent of, Medicaid recipients were treated with an oral antibiotic medication. Similarly, when the time frame was expanded from five days to seven and ten days, respectively, the prevalence of treatment was 64 percent and 65 percent.

'Cost' Description

The total amount *paid* by Medicaid for 30,961 physician outpatient visits during the study period for acute, nonbacterial respiratory tract infections was \$1,346,577. The average amount paid per recipient was \$56 (standard deviation=\$44.79) and the median amount paid per recipient was \$46. The total amount paid for 7478 emergency department visits, which accounted for 24 percent of all outpatient visits during the period, was \$378,663, or 28 percent of the total amount paid for all outpatient visits for acute, nonbacterial respiratory tract infections.

For each of the oral antibiotics shown in Table 2, we identified the most common quantity of pills dispensed (i.e., the mode of the distribution) and the median price per pill. These values, in addition to the number of prescriptions or claims, were multiplied together to obtain an estimate of the total cost for each medication. The total estimated cost of the 33,061 oral antibiotic prescriptions filled within five days of a physician outpatient visit for acute, nonbacterial respiratory tract infection during the six month study period was more than \$1.5 million.

Discussion

Despite numerous efforts during recent years to educate the public and the medical community about the importance of reducing antimicrobial resistance, antibiotic prescribing rates remain at undesirable levels. Our results demonstrate that 63 percent of North Carolina Medicaid recipients without documented chronic lung disease who made at least one outpatient physician visit during the observation period for acute, nonbacterial respiratory tract infection were treated with an oral antibiotic within five days of the physician outpatient visit. This finding is similar to those reported by studies conducted in Kentucky during 1995 using Medicaid data which observed antibiotic prescription rates of 60 percent for common cold and 75 percent for acute bronchitis.

We also observed geographic variation in the prevalence of oral antibiotic treatment. Antibiotic prescribing rates are higher in rural areas compared to urban areas and are slightly higher in the eastern counties of the state compared with those in the central region (64.8 vs. 63.7 percent, $p=0.01$) and the western region (64.8 vs. 59.0 percent, $p<0.01$). The higher antibiotic treatment rate in eastern North Carolina correlates with lower susceptibility, or higher resistance, identified by Stein and colleagues, who observed the percent of pneumococci susceptible to penicillin during 2000 was 45.3 percent in eastern counties of North Carolina, 55.5 percent in central counties, and 51.9 percent in western counties (5).

Reducing rates of antibiotic usage for common, non-life threatening upper respiratory tract infections has important implications not only for both immediate and future antimicrobial resistance problems, but for healthcare costs as well. The total cost of 43,709 oral antibiotic prescriptions by persons making at least one a physician outpatient visit for acute, nonbacterial

respiratory tract infection was more than \$2 million, and the cost for those prescriptions made within five days of an outpatient visit was more than \$1.5 million.

The results of this study are subject to several limitations. First, we were not able to directly link a prescription to an outpatient visit or health care episode. It is certainly possible for a patient to receive one of the oral antibiotics listed in Appendix B for reasons other than treatment of acute, nonbacterial respiratory infections. To address this issue, we excluded persons with several common chronic upper respiratory conditions for which antibiotic treatment may be indicated. In addition, more than 75 percent of all oral antibiotic pharmacy claims filled by Medicaid recipients making an office or emergency department visit for acute, nonbacterial respiratory tract infections occurred within five days of the visit. Thus, we are confident that we have done our best to capture antibiotic treatment for the study conditions rather than other conditions where such treatment may be indicated. Second, it is possible that some Medicaid recipients treated for an acute, nonbacterial respiratory tract infection may have been given office samples or received a prescription for oral antibiotics without making an office visit. Because we used administrative pharmacy claims data to identify prescriptions, we will not capture these instances of oral antibiotic prescription.

Pilot Study Description

In many cases it is difficult for a physician to avoid prescribing an antibiotic due to perceived patient expectation, as well as time constraints (e.g., it takes longer to explain why an antibiotic is not warranted than to write a prescription for one). However, there is some evidence that patients are willing to avoid antibiotic use if their clinician does not believe it is warranted.

To assist physicians in their efforts to decrease antibiotic prescribing for common upper respiratory tract infections, we developed a “Self-Care Kit” which contains symptom relieving items as well as a Centers for Disease Control and Prevention pamphlet reviewing the concerns of antimicrobial resistance. The “Self-Care Kit” package items were determined in collaboration with a focus group of primary care physicians.

To assess physician and patient response to these packets, we distributed approximately 1150 “Self-Care Kits” within four North Carolina medical clinics. To evaluate the impact of providing patients with the Self-Care Kit on antibiotic prescribing practices, we will compare the proportion of patients prescribed an antibiotic within the four intervention clinical practices and within four randomly selected similar control clinics. Should this pilot project prove successful in favorably changing prescribing practices, we hope that similar patient-focused interventions may be distributed both by Medicaid and healthcare providers to further reduce antimicrobial resistance and lower associated healthcare costs.

Summary

Antibiotic prescribing for common acute, nonbacterial respiratory tract infections in North Carolina is at higher than desirable levels and correlates with antimicrobial resistance across the state. Ongoing efforts will be required to assist physicians in making it easier to avoid prescribing antibiotics, and to monitor the effects of these interventions on resistance. It is very likely that combating this problem will require a multifaceted approach, and we welcome suggestions from providers, patients and insurance companies on furthering our efforts.

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Appendix A

North Carolina Area Health Education Center (AHEC) Region	County
Mountain	Buncombe [†] , Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania, Yancey
Northwest	Alexander, Alleghany, Ashe, Avery, Burke, Caldwell, Catawba [†] , Davidson [†] , Davie, Forsyth [†] , Iredell, Rowan [†] , Stokes, Surry, Watauga, Wilkes, Yadkin
Charlotte	Anson, Cabarrus [†] , Cleveland, Gaston [†] , Lincoln, Mecklenburg [†] , Stanly, Union
Greensboro	Alamance [†] , Caswell, Chatham, Guilford [†] , Montgomery, Orange [†] , Randolph, Rockingham
Southern	Bladen, Cumberland [†] , Harnett, Hoke, Moore, Richmond, Robeson, Sampson, Scotland
Wake	Durham [†] , Franklin, Granville, Johnston, Lee, Person, Vance, Wake [†] , Warren
Area L	Edgecombe, Halifax, Nash, Northampton, Wilson
Coastal	Brunswick, Columbus, Duplin, Pender, New Hanover [†]
Eastern	Beaufort, Betrie, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Greene, Hertford, Hyde, Jones, Lenior, Martin, Onslow [†] , Pamlico, Pasquotank, Perquimans, Pitt, Tyrrell, Washington, Wayne

[†] Indicates an urban county, defined as a county which includes a standard metropolitan statistical area as defined by the U.S. Bureau of the Census in 1990 with a population density greater than 190 residents per square mile

Appendix B

Brand name (generic name)	Brand name (generic name)
Amoxil, Trimox (amoxicillin)	Lorabid (loracarbef)
Augmentin (amoxicillin-clavulanate)	Cipro (ciprofloxacin)
Principen (ampicillin)	Penetrex (enoxacin)
Spectrobid (bacampicillin)	Tequin (gatifloxacin)
Dynapen, Dycill (dicloxacillin)	Raxar (grepafloxacin)
Pen-V, Veetids, (penicillin)	Levaquin (levofloxacin)
Zithromax, Z-pak (azithromycin)	Maxaquin (lomefloxacin)
Biaxin (clarithromycin)	Avelox (moxifloxacin)
Cleocin (clindamycin)	NegGram (nalidixic acid)
Dynabac (dirithromycin)	Noroxin (norfloxacin)
E.E.S., EryPed, Ery-Tab/Erythrocin (erythromycin)	Floxin (ofloxacin)
Ceclor (cefaclor)	Zagam (sparfloxacin)
Duricef (cefadroxil)	Trovan (trovafloxacin)
Omnicef (cefdinir)	Declomycin (demeclocycline)
Suprax (cefixime)	Doryx, Periostat, Vibramycin, Vibra-tabs (doxycycline)
Vantin (cefepodoxime)	Dynacin, Minocin, Vectrin (minocycline)
Cefzil (cefprozil)	Achromycin (tetracycline)
Cedax (ceftibutin)	Bactrim, Septra, Pediazole (trimethoprim-sulfamethoxazole)
Ceftin (cefuroxime)	Zyvox (linezolid)
Keflex (cephalexin)	Flagyl (metronidazole)
Velosef (cephadrine)	

TABLE 1. Characteristics of 24,137 North Carolina Medicaid recipients with at least one physician outpatient visit between October 1, 2000 and March 29, 2001 for a principal diagnosis of acute nasopharyngitis (common cold),* acute upper respiratory infection,[†] acute pharyngitis,[‡] acute bronchitis,[§] or influenza[¶] by number of visits

Characteristic	Number of visits		
	1 (N = 19,158)	2 (N = 3700)	≥ 3 (N = 1279)
	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>
Age (years)**			
18–29	6488 (33.9)	1086 (29.3)	305 (23.9)
30–39	4616 (24.1)	955 (25.8)	316 (24.7)
40–49	3621 (18.9)	757 (20.5)	284 (22.2)
50–59	3102 (16.2)	624 (16.9)	253 (19.8)
60–64	1331 (6.9)	278 (7.5)	121 (9.5)
<i>mean (std dev)</i>	37.6 (13.4)	38.6 (13.1)	40.6 (13.2)
Women**	14,902 (77.8)	2941 (79.5)	1028 (80.4)
Race/ethnicity**			
White	10,426 (54.4)	2149 (58.1)	819 (64.0)
Black	6778 (35.4)	1144 (30.9)	315 (24.6)
Other	1954 (10.2)	407 (11.0)	145 (11.3)

TABLE 1. (continued)

Characteristic	Number of visits		
	1 (N = 19,158)	2 (N = 3700)	≥ 3 (N = 1279)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Rural**	13,110 (68.4)	2600 (70.3)	922 (72.1)
North Carolina AHEC Region			
Mountain	2032 (10.6)	359 (9.7)	117 (9.1)
Northwest	3476 (18.1)	688 (18.6)	238 (18.6)
Charlotte	2181 (11.4)	437 (11.8)	151 (11.8)
Greensboro	1871 (9.8)	373 (10.1)	133 (10.4)
Southern	2688 (14.0)	527 (14.2)	204 (15.9)
Wake	1741 (9.1)	336 (9.1)	97 (7.6)
Area L	893 (4.7)	149 (4.0)	49 (3.8)
Coastal	1109 (5.8)	214 (5.8)	72 (5.6)
Eastern	3167 (16.5)	617 (16.7)	218 (17.0)

* ICD-9 code 460.x.

† ICD-9 code 465.9.

‡ ICD-9 code 462.x.

§ ICD-9 code 466.0.

¶ ICD-9 code 487.1.

** Statistically significant difference across visit groups, $p < 0.05$.

TABLE 2. Frequency of Medicaid pharmacy claims (overall and within five days of an outpatient visit), the number of pills dispensed per prescription, the price per pill, and prescription costs for oral antibiotics prescriptions filled within five days of an outpatient visit among North Carolina Medicaid recipients making at least one physician outpatient visits for acute, nonbacterial respiratory tract infections

Drug Name	Overall		Prescription within 5 days of outpatient visit			
	<i>n</i>	(%)*	<i>n</i>	(%)†	Pills Dispensed‡	Price per Pill§ Total Cost¶
Penicillins	11,212	(25.7)	8430	(25.5)	–	– \$276,486
Amoxicillin	6210	(14.2)	4765	(14.4)	30	\$0.13 \$18,155
Amoxicillin-clavulanate	3224	(7.4)	2444	(7.4)	20	\$5.19 \$253,687
Ampicillin	132	(0.3)	91	(0.3)	40	\$0.11 \$406
Dicloxacillin	42	(0.1)	23	(0.1)	40	\$0.76 \$696
Penicillin	1604	(3.7)	1107	(3.4)	40	\$0.08 \$3,542
Erythromycins/Lincosamides/Macrolides	14,161	(32.4)	11,565	(35.0)	–	– \$524,639
Azithromycin	9472	(21.7)	7850	(23.7)	6	\$6.97 \$328,424
Clarithromycin	2630	(6.0)	2154	(6.5)	20	\$3.95 \$170,140
Clindamycin	524	(1.2)	314	(1.0)	28	\$0.92 \$8,115
Dirithromycin	226	(0.5)	191	(0.6)	10	\$3.26 \$6,220

TABLE 2 (continued)

Drug Name	Overall		Within 5 days of outpatient visit			
	<i>n</i>	(%)*	<i>n</i>	(%)†	Pills Dispensed‡	Price per Pill§ Total Cost¶
Erythromycin	1309	(3.0)	1056	(3.2)	30	\$0.37 \$11,741
Cephalosporins	5914	(13.5)	4176	(12.6)	—	— \$201,175
Cefaclor	632	(1.5)	505	(1.5)	20	\$4.41 \$44,588
Cefadroxil	241	(0.6)	146	(0.4)	20	\$3.05 \$8,906
Cefdinir	139	(0.3)	114	(0.3)	20	\$3.93 \$8,957
Cefixime	76	(0.2)	56	(0.2)	10	\$8.01 \$4,485
Cefpodoxime	135	(0.3)	91	(0.3)	20	\$4.20 \$7,644
Cefprozil	591	(1.4)	472	(1.4)	20	\$3.57 \$33,683
Ceftibuten	113	(0.3)	89	(0.3)	10	\$7.89 \$7,019
Cefuroxime	1048	(2.4)	806	(2.4)	20	\$4.20 \$67,704
Cephalexin	2866	(6.6)	1842	(5.6)	30	\$0.22 \$11,881
Cephradine	3	(0.0)	2	(0.0)	24	\$0.99 \$47
Loracarbef	70	(0.2)	53	(0.2)	20	\$5.91 \$6,261

TABLE 2 (continued)

Drug Name	Overall		Within 5 days of outpatient visit			
	<i>n</i>	(%)*	<i>n</i>	(%)†	Pills Dispensed‡	Price per Pill§ Total Cost¶
Quinolones	7602	(17.4)	5563	(16.8)	—	— \$444,279
Ciprofloxacin	2189	(5.0)	1303	(3.9)	20	\$4.51 \$117,632
Gatifloxacin	1515	(3.5)	1261	(3.8)	7	\$7.78 \$68,664
Levofloxacin	3085	(7.1)	2357	(7.1)	10	\$8.53 \$201,146
Moxifloxacin	670	(1.5)	566	(1.7)	10	\$8.71 \$49,313
Nalidixic acid	2	(0.0)	1	(0.0)	120	\$1.66 \$199
Norfloxacin	22	(0.1)	14	(0.0)	20	\$3.81 \$1,066
Ofloxacin	117	(0.3)	59	(0.2)	20	\$5.19 \$6,124
Sparfloxacin	2	(0.0)	2	(0.0)	10	\$6.69 \$134
Tetracyclines	2129	(4.9)	1566	(4.7)	—	— \$76,037
Demeclocycline	7	(0.0)	6	(0.0)	48	\$9.30 \$2,678
Doxycycline	1787	(4.1)	1352	(4.1)	20	\$2.40 \$64,896
Minocycline	105	(0.2)	65	(0.2)	60	\$1.95 \$7,605

TABLE 2. (continued)

Drug Name	Overall		Within 5 days of outpatient visit				
	<i>n</i>	(%)*	<i>n</i>	(%)†	Pills Dispensed‡	Price per Pill§	Total Cost¶
Tetracycline	230	(0.5)	143	(0.4)	60	\$0.10	\$858
Sulfonamides and Trimethoprim	2690	(6.2)	1760	(5.3)	—	—	\$7,286
Sulfamethoxazole-trimethoprim	2690	(6.2)	1760	(5.3)	20	\$0.21	\$7,286
Oxazolidone	1	(0.0)	1	(0.0)	—	—	\$2,231
Linezolid	1	(0.0)	1	(0.0)	42	\$53.13	\$2,231
Total	43,709		33,061		—	—	\$1,532,134

* Percentage given is based on the total number of oral antibiotic claims ($n=43,709$) between October 1, 2000 and April 5, 2001 for 24,137 adult Medicaid recipients with at least one outpatient visit for acute, nonbacterial respiratory tract infections

† Percentage given is based on the total number of oral antibiotic claims within 5 days of an outpatient visit ($n=33,061$)

‡ Number of pills dispensed per prescription for each drug based on the mode of the distribution

§ Price per pill obtained from the North Carolina Division of Medical Assistance and reflects the effective price for the period April 4, 2000 through March 31, 2001

¶ Total cost = (# of claims within five days) x (Modal # of pills dispensed per claim) x (Price per pill)

TABLE 3. Prevalence of oral antibiotic treatment among North Carolina Medicaid recipients with at least one physician outpatient visit between October 1, 2000 and March 29, 2001 for a principal diagnosis of acute nasopharyngitis (common cold),* acute upper respiratory infection,[†] acute pharyngitis,[‡] acute bronchitis,[§] or influenza[¶] by number of visits and recipient characteristics

Characteristic	Number of visits					
	1 (N = 19,158)		2 (N = 3700)		≥ 3 (N = 1279)	
	n (%)**	OR (95% CI) ^{††}	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Age (years)						
18–29	3676 (56.7)	0.84 (0.74, 0.94)	830 76.4	0.84 (0.61, 1.17)	272 89.2	1.80 (0.99, 3.28)
30–39	2747 (59.5)	0.94 (0.83, 1.06)	727 76.1	0.83 (0.60, 1.15)	279 88.3	1.64 (0.91, 2.95)
40–49	2091 (57.7)	0.86 (0.75, 0.98)	576 76.1	0.82 (0.59, 1.15)	247 87.0	1.39 (0.78, 2.50)
50–59	1895 (61.1)	0.98 (0.86, 1.12)	500 80.1	1.03 (0.73, 1.47)	207 81.8	0.95 (0.54, 1.69)
60–64	821 (61.2)	1.00	221 79.5	1.00	100 82.6	1.00
Gender						
Women	8669 (58.2)	0.94 (0.87, 1.00)	2256 76.7	0.90 (0.74, 1.10)	886 86.2	0.87 (0.57, 1.32)
Men	2561 (60.2)	1.00	598 78.8	1.00	219 87.3	1.00

TABLE 3. (continued)

Characteristic	Number of visits					
	1 (N = 19,158)		2 (N = 3700)		≥ 3 (N = 1279)	
	<i>n</i> (%)**	OR (95% CI) ^{††}	<i>n</i> (%)	OR (95% CI)	<i>n</i> (%)	OR (95% CI)
Race/ethnicity						
White	6154 (59.0)	0.91 (0.83, 1.01)	1664 (77.4)	1.02 (0.79, 1.33)	705 86.1	0.74 (0.43, 1.29)
Black	3872 (57.1)	0.85 (0.76, 0.95)	874 (76.4)	0.97 (0.74, 1.27)	272 86.3	0.79 (0.43, 1.44)
Other	1204 (61.6)	1.00	316 (77.6)	1.00	128 88.3	1.00
Residence						
Rural	7811 (59.6)	1.13 (1.06, 1.20)	2023 (77.8)	1.13 (0.96, 1.34)	798 86.5	1.05 (0.73, 1.50)
Urban	3419 (56.5)	1.00	831 (75.5)	1.00	307 86.0	1.00
Total	11,230 (58.6)		2854 (77.1)		1105 (86.4)	

* ICD-9 code 460.x.

† ICD-9 code 465.9.

‡ ICD-9 code 462.x.

§ ICD-9 code 466.0.

¶ ICD-9 code 487.1.

** Number and percent receiving oral antibiotic treatment within 5 days of the physician outpatient visit.

†† Odds ratios (ORs) and 95% confidence intervals (CIs) adjusted for all variables in the table.

TABLE 4. Prevalence of oral antibiotic treatment among North Carolina Medicaid recipients with at least one outpatient visit between October 1, 2000 and March 29, 2001 for a principal diagnosis of acute nasopharyngitis (common cold),* acute upper respiratory infection,[†] acute pharyngitis,[‡] acute bronchitis,[§] or influenza[¶] by number of visits and principal diagnosis

Condition	Number of visits					
	1 (N = 19,158)		2 (N = 3700)		≥ 3 (N = 1279)	
	n (%)**	OR (95% CI) ^{††}	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Acute nasopharyngitis	106 (31.5)	0.32 (0.25, 0.40)	60 (60.6)	0.45 (0.30, 0.68)	29 (80.6)	0.69 (0.29, 1.61)
Acute pharyngitis	2309 (60.8)	1.18 (1.10, 1.27)	758 (79.8)	1.32 (1.09, 1.59)	344 (91.5)	1.91 (1.27, 2.89)
Acute URI	2807 (44.5)	0.42 (0.39, 0.44)	1111 (71.3)	0.56 (0.48, 0.66)	511 (84.2)	0.65 (0.47, 0.91)
Acute bronchitis	5784 (73.0)	2.92 (2.74, 3.11)	1833 (84.4)	2.75 (2.34, 3.24)	838 (89.1)	2.55 (1.80, 3.63)
Influenza	224 (28.4)	0.27 (0.23, 0.31)	143 (66.5)	0.58 (0.43, 0.78)	63 (73.3)	0.35 (0.21, 0.59)

* ICD-9 code 460.x.

† ICD-9 code 465.9.

‡ ICD-9 code 462.x.

§ ICD-9 code 466.0.

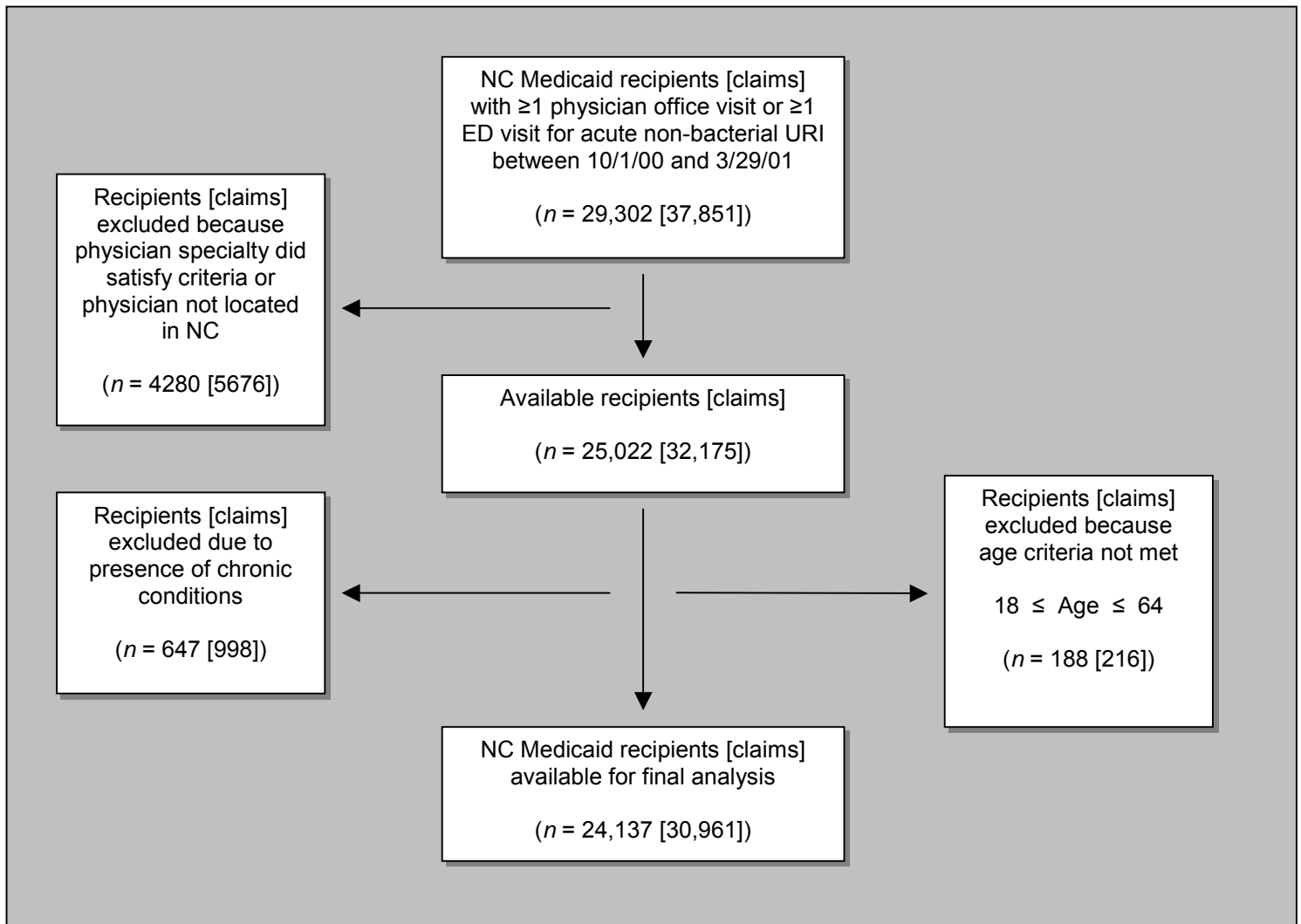
¶ ICD-9 code 487.1.

** Number and percent receiving oral antibiotic treatment within 5 days of an office visit.

†† Prevalence odds ratio (OR) and 95% confidence interval (CI) adjusted for age, race/ethnicity, gender, rural/urban residence.

Referent group for each principal diagnosis is all other principal diagnosis groups.

FIGURE 1. Flow of Medicaid recipients and claims meeting study inclusion and exclusion criteria



Note: n = # Medicaid recipients [# Medicaid claims]

FIGURE 2. Frequency of outpatient claims by diagnosis and visit setting

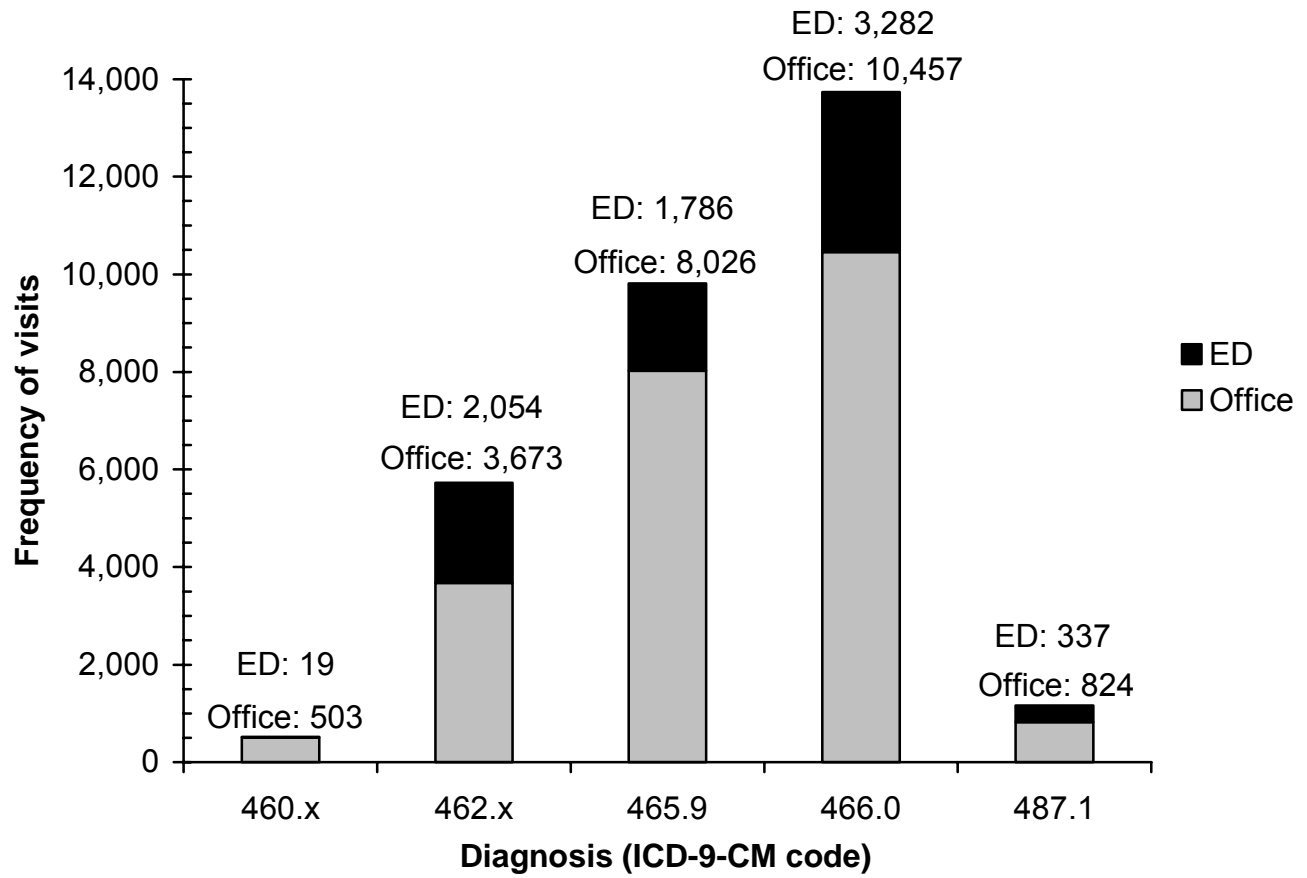
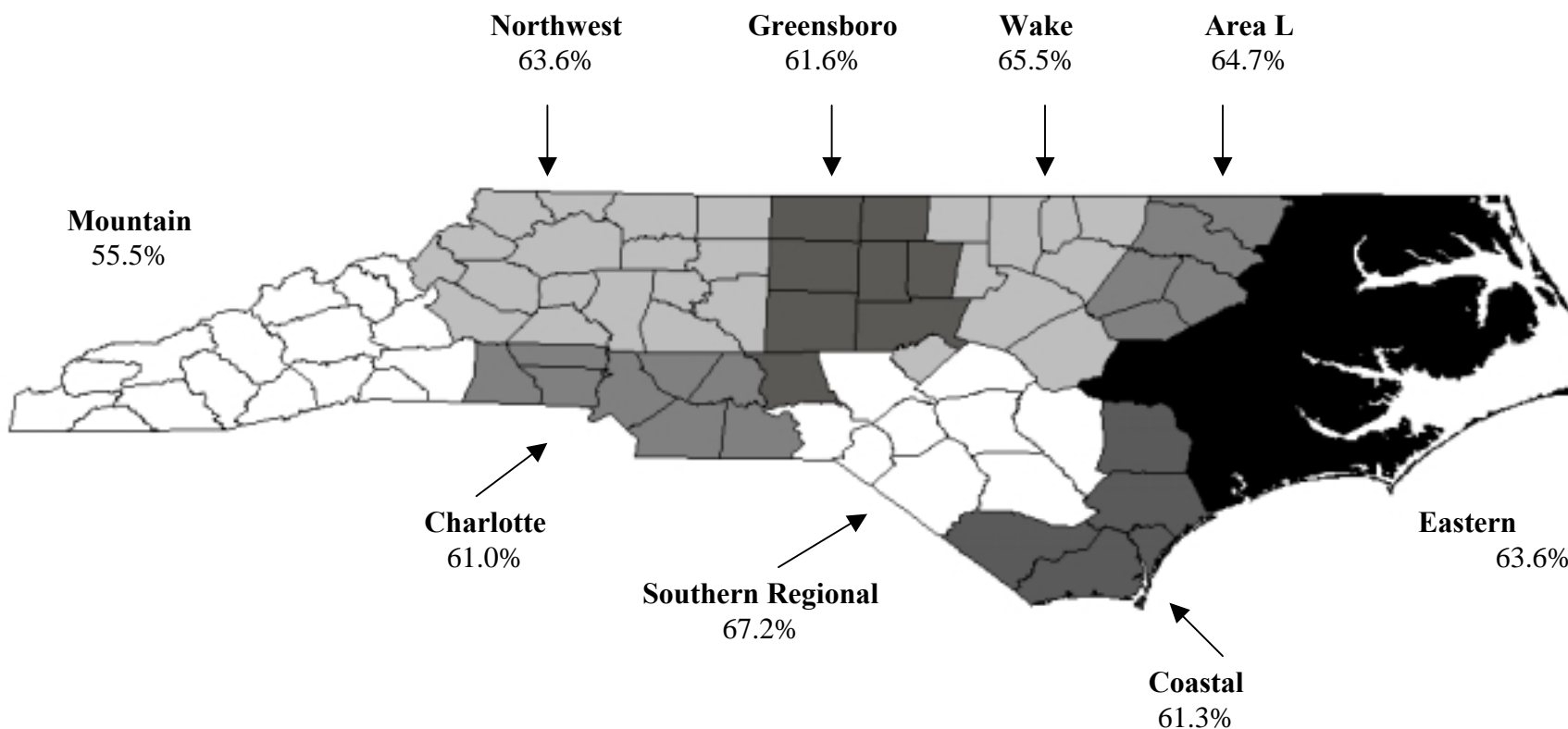


FIGURE 3. Prevalence of oral antibiotic treatment between October 1, 2000 and March 29, 2001 among North Carolina Medicaid recipients with at least one outpatient visit for a principal diagnosis of acute nasopharyngitis (common cold), acute upper respiratory infection, acute pharyngitis, acute bronchitis, or influenza, by Area Health Education Center (AHEC) region.*



* See Appendix B for counties in each AHEC region.

** Prevalence estimates have been adjusted for the number of outpatient visits.